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Journal of Heat Transfer

Guest Editorial

On Professor John H. Lienhard's 91st Birthday

Dr. John H. Lienhard IV, ASME Fellow and M.D. Anderson Professor Emeritus of Technology and Culture at the University of Houston, celebrated his 91st birthday on August 17th, 2021. In honor of the occasion, his former students, colleagues, and friends join in wishing him a belated happy birthday. Before presenting our felicitations, we begin by giving a brief history of John's remarkable and diverse 60 year career as an engineer, educator, author, historian and, notably, as the voice of a nationally syndicated radioprogram on technology.

John H. Lienhard IV was born in 1930 in Saint Paul Minnesota and grew up in Roseburg, Oregon. After receiving his bachelor's degree from the Oregon State College, he worked at Boeing Co. in Seattle Washington while earning his master's degree from the University of Washington, Seattle. After being drafted in the Signals Corps Laboratory of the U.S. Army, he joined the University of California Berkeley and obtained his Ph.D. in Mechanical Engineering, in 1961 (the photograph in Fig. 1 shows John during his army days visiting MIT). Over his academic career, John has taught at five Universities: the University of Washington, the University of California, Berkeley, Washington State University, the University of Kentucky and the University of Houston.

His research with his students and colleagues has beautifully combined thermodynamic processes, thermal science, and engineering. He is well known for his seminal contributions to phase change heat transfer including the development of a comprehensive hydrodynamic theory of Maximum and Minimum heat fluxes in pool boiling. Experimental and theoretical work has included the effect of such variables as heater size, geometry, gravity level, fluid properties and flow configuration. To scale the effect of gravity on boiling phenomenon he was amongst the first to use a centrifuge. In the area of film condensation his focus was on modeling the effect of variable gravity or body shape. His studies on thermodynamic stability of fluids have included the spinodal limit of liquid superheat, superheated liquid jet stability, and rapid water depressurization.

In 1971, John coauthored a textbook on Statistical Thermodynamics with the late Prof. C.L. Tien (Fig. 2 shows a photograph of John Lienhard and C.L. Tien with John's student Bill Sun). A decade later John wrote a textbook on Heat Transfer, which is now in its fifth edition (2019). The last three editions of this book have been coauthored with his son Prof. John H. Lienhard V, a faculty member at Massachusetts Institute of Technology. The book has also been available as a free e-book since 2001 and is one of the earliest to be offered in this manner. A photograph following John's book signing is shown in Fig. 3.

In the late nineteen seventies, John's interests shifted toward the history of science, technology, innovation, and culture. He developed and taught courses on these topics both at the University of Kentucky and the University of Houston. In 1988, he created the radioprogram, "*The Engines of Our Ingenuity*" and has written and voiced most of the episodes—now numbering more than 3200. The radioprogram is produced and aired by Houston Public Media and syndicated through National Public Radio and the U.S. Armed Forces Radio.

John has been a sought-after public speaker, having given almost 1100 invited lectures and addresses. He has also been kind in donating the honoraria received from the talks to create the Engines of Our Ingenuity Undergraduate Scholarship endowment at the University of Houston. Photography is another of John's passions. Figure 4 shows a photograph taken by John at a conference in Lake Placid in New York. His photos are found throughout the *Engines of our Ingenuity* website.

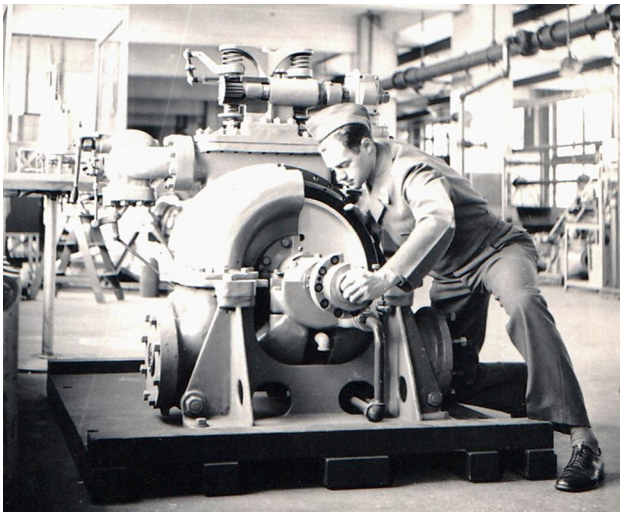

Fig. 1 John Lienhard looking at a cut-away turbine in the Steam Power Lab at MIT in 1953

Fig. 2 Professors John Lienhard and the late Chang-lin Tien (UCB) with John's former student Bill Sun (EPRI, center)

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Fig. 3 Following John's book signing at Barnes and Noble in Houston—outside his residence, fall 2000. From left to right, Amir Karimi (UTSA), the late Roger Eichhorn (U of Houston), the late Stephen Juhasz (Southwest Research) and John Lienhard.

Fig. 4 Photograph taken by John Lienhard. From left to right, Carol Lienhard, the late Towneley Rohsenow, Richard Lahey (RPI), Vijay Dhir (UCLA), (?), and the late Virgil Schrock (John's Ph.D. advisor, UCB).

Professor Lienhard has received many honors and awards. He is a member of the U.S. National Academy of Engineering. He is a Fellow of the American Association for the Advancement of Science and the American Society of Mechanical Engineers (ASME). He is recipient of Charles Russ Richards Medal of Tau Pi Sigma and ASME, Heat Transfer Memorial Award of ASME, Ralph Coats Roe Medal of ASME, and Robert Henry Thurston Lecture of ASME. His other recognitions include American Society of Engineering Education's Ralph Coats Roe Award, Engineer-Historian Award of ASME, the ASME Edwin F. Church Medal and election as an Honorary Member of ASME. In 2002, he received a Doctorate in Humane Letters, honoris causa, from the University of Houston and another Honorary Doctorate from Sacred Heart University, Fairfield, CT.

His past students, colleagues, and friends hold him in very high esteem. Brief excerpts from their writings are reproduced here:

Amir Karimi writes,

> "I have had the honor of knowing John Lienhard as a mentor and a friend for nearly 48 years. For my Ph.D. dissertation, I worked on development of a fundamental equation to predict the thermodynamic properties of water in the metastable region. John is a person with a deep sense of curiosity in science and technology. He can recognize things most others miss. A quote from John states: **Invention is a matter of catching the fleeting idea as it whips past you, and other people miss it.** He is a multidimensional person. At the University of Texas San Antonio, I have used John's heat transfer textbook many times in my undergraduate and introductory graduate courses during my teaching career. In addition to being a distinguished scientist and historian he has many other interests. As I recall, he sang in musical theater productions when he was living in Lexington, KY. He also has an interest in photography. I feel fortunate meeting John. I have learned a great deal from him as my mentor and it has been a blessing knowing him as a friend. I have the deepest gratitude and appreciation for all he has done for me."

Fig. 5 is a photograph taken at Dinner in San Antonio, TX in 2015.

Eugene Ungar writes,

> "John's abiding interest in the history of technology led him to create *The Engines of Our Ingenuity* radioprogram. The first program was broadcast in 1988 over KUHF-FM, the University of Houston's public broadcast radiostation. The program's reach has grown over time, and it is now nationally broadcast on National Public Radio.
>
> Each four-minute vignette explores a facet of technology and its affect on civilization. John weaves information about technological development with cultural history to provide a brief informative, enjoyable look at the advance of civilization from an engineer's perspective. Since its inception, over 3000 unique episodes have been broadcast. Transcript and audio of the episodes are available at https://www.uh.edu/engines/."

Mojibul Hasan writes,

> "His generalized interpretation of boiling phenomena utilizing the scaling parameters involving appropriate length scales, gravity, inertia and surface tension forces, and identifying the criteria to determine gravity influence and inertia dominated boiling regimes have proven to be very useful for the Space and Planetary based thermal systems design."

Fig. 5 John and Carol Lienhard at Dinner after 2015 ASEE-GSW section annual conference in San Antonio. From left to right, Laurie Manteufel, Carol Lienhard, John Lienhard, the late Colleen Karimi, Amir Karimi (UTSA), Heidar Maleki (U of Houston), Reza Mirshams (UNT), and Randy Manteufel (UTSA).

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Robert Mahan, comments,

"Writing about John H. Lienhard IV is a little like a street-fair caricaturist whipping out an offhand portrait of Johannes Vermeer: while I may get the comb-over right. I am doomed to miss the rich nuances that characterize the man. In the classroom Prof. Lienhard taught me Statistical Thermo, surface Energy and Stability, and Compressible Flow. These were far and away the most challenging courses I took in grad school, and I doubt if I earned an A in any of them. However, the gut-wrenching intellectual wind sprints I endured while striving made my other coursework seem like a walk in the park. The scholarly endurance and intellectual stamina inculcated by this famously exigent educator accounts in no small measure for any success I may have enjoyed during the course of a 50-year academic career. John's unrivaled ability as a wordsmith has inspired my own humble attempts at technical discourse.

John Lienhard's accomplishments as an educator, creator of new knowledge, and chronicler of old knowledge are such that it might be forgivable to overlook one of his greatest attributes: his professional and personal honesty. As a member of my doctoral committee John signed my 1970 dissertation despite confiding that the writing was "doughy" and when I asked his advice about including my grades in my job-search dossier, he replied, "But, Bob, they simply aren't that good." I also recall the correction he published to one of his *Journal of Heat Transfer* articles that he later found to contain an unreproducible correlation.

A half century has slipped by since my graduate student years. Many of my memories of those times have faded, pleasant though they no doubt were. But I will carry to the grave my indelible memories of the time spent at the elbow of and-with my fellow graduate students-in the home of John Lienhard."

Vijay Dhir writes,

"There are events and people that profoundly impact one's life. For me it was studying, learning, doing research and knowing Prof. Lienhard. During the time I was a Ph.D. student at the University of Kentucky, I learnt from him the value of hard work, dedication and of thinking independently and creatively. Weekends provided a great opportunity for me to discuss research and new ideas with him without any interruption or inhibition. We had a very productive four years in research, working on problems in phase change heat transfer including Boiling and Condensation.

Aside from being a scholar, teacher, writer and speaker of the highest distinction, John has been a great motivator and mentor. I have tried to emulate as much as I can these traits in my own academic life. As they, say, influence of a great teacher is ever lasting and one can never pay off debt to one's parents, I can safely say that I owe an enormous debt of gratitude to John Lienhard for all that I am today."

Yousri Elkassabgi comments,

"Upon becoming Dr. Lienhard's student, he helped me to discover, not only a lifetime passion for research in heat transfer and thermodynamics but showed me by example the impact that a professor can make in the lives of their students. I also learned, among many other things, the art of proposal writing, the art of leading with your gut in research and empathy with respect to being aware of every student's unique situation and needs. Dr. Lienhard's example whether in the office, the lab or the classroom has set the foundation for which I strive for every day in my career.

Dr. Lienhard's teachings extended beyond academia and helping a young immigrant man, as was the case with myself, learn how to adjust and succeed in achieving the American dream. Dr. Lienhard took the time to advise me on the smallest matters, such as which ketchup was the best value at the supermarket to the best time of the year to buy a car. He served as a guide to American culture allowing me the opportunity to adapt to and thrive in a new country. To this day, I continue to share his words of wisdom and his example with my children, grandchildren, and my students.

I am forever grateful for Dr. Lienhard's leadership and personal dedication to his students, and I will continue to strive to become his vision of what I could be."

Larry Witte, a colleague at the University of Houston writes,

"It has been my pleasure to be his colleague for about 45 years as well as knowing his work prior to that. John's specialty is phase change heat transfer – a difficult research field because its understanding requires inputs from basic sciences, thermodynamics, and fluid mechanics, as well as the properties of fluids. John and his colleagues and graduate students tackled many aspects of boiling using sophisticated methods of fluids and thermodynamics. The understanding of the role of bubble action and the stability of interfaces was greatly improved by his studies. Showing how liquid–vapor interfaces behave and contribute to nucleate and film boiling and examining the behavior in the transition zone between them is one of the major contributions of he and his colleagues. Indeed, he has also examined the basic behavior of substances during pressure-temperature changes, namely, spinodal behavior and shed considerable light on processes involved. His work has earned many honors in his field, for example, the Heat Transfer Memorial Award, the recognition that all heat transfer researchers aspire to, and election to the National Academy of Engineering among many others. But heat transfer is not the only technology that interests him. His writings that relate to how technology has furthered the standard of living in the industrial world led him to develop *The Engines of Our Ingenuity*, as radioshow broadcast primarily by NPR stations around the country. He has produced over 3000 shows that were widely acclaimed. He has also been a much sought-after speaker, lending his expertise and brilliant oratory to basic explanations of importance of technology in general, and to the importance of advanced education as it contributes to maintaining a solid underpinning for further advances in industrial processes.

To sum up, John Lienhard has one of the most inquisitive minds of anyone I have known. That combined with a brilliant ability to put his thoughts in writing and to deliver them in an equally effective speaking manner sets him apart from most of his colleagues."

Raj M. Manglik, a colleague, writes,

"A highly noteworthy contribution of Professor Lienhard has been the popular enunciation of engineering inventiveness and technology development. This began in 1988 with a radioprogram, *The Engines of Our Ingenuity*, on public radio (produced by Houston Public Media), wherein he artfully and persuasively gave cultural context to the "engines" engineered and constructed by mankind. Albeit with rather strong biblical underpinnings, John extolled in these podcasts via creative stories about how culture takes shape on the basis of continuous human creativity. He suggests that the latter comes from our inherent desire to seek new experiences and for which humans contribute "repeatedly in everyday life." In other words, inventions are not singular achievements of individuals but stem from a conglomeration of small contributions in time that get assembled in the artifact. For example, as John surmises, the craving for speed evolved into the automobile and airplane with collective inputs from society. The podcasts eventually led to the publication of a book (Fig. 6) with the same title but a qualifying subtitle: *The Engines of Our Ingenuity: An Engineer Looks at Technology and Culture* (Oxford University Press, 2000). Subsequently, this endeavor of popularizing technological advancements and giving them both a historical and contemporary cultural context led to two other books: *Inventing Modern: Growing up with X-Rays, Skyscrapers, and Tailfins*, Oxford University Press, 2003; and *How Invention Begins: Echoes of Old Voices in the Rise of New Machines*, Oxford University Press, 2006 (see Fig. 6 for the front cover). The ability to tell one's stories, unconstrained from the idioms and nomenclatures of scientific and engineering explorations, to a very wide audience is surely something all can and should emulate."

A friend and colleague Thomas Avedisian comments,

"Professor Lienhard is world-renowned for his many technological achievements. For example, his work on boiling heat transfer and phase transitions of metastable superheated liquids is representative. Prof. Lienhard's clever use of dimensional analysis extended the original ideas of Zuber for CHF on a large flat surface with no inflow of fluid to more realistic geometries-cylinders, spheres, vertical walls, wires, etc. – through correlations of CHF showing a heater size effect that are widely used in many applications. And his work on phase transitions of fluids in the metastable state has provided elegant insights through simple formulations borrowed from theories of near-critical point phenomenon to predict the nucleation threshold and superheat conditions that govern a wide range of applications such as the "vapor explosion" phenomenon relevant to rapid blowdown of liquids from high pressure, nuclear reactor safety, liquid natural gas spills and others.

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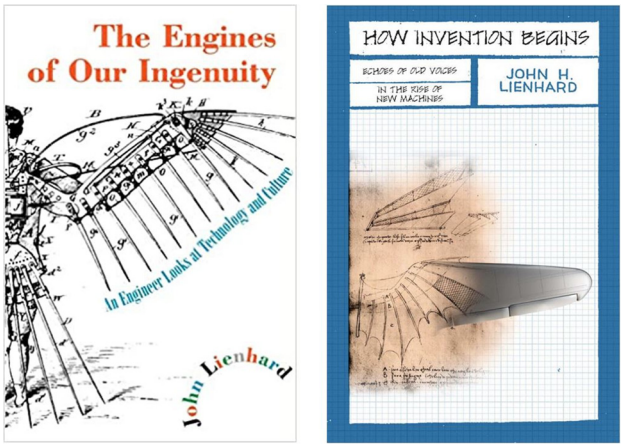
The Engines of Our Ingenuity
An Engineer Looks at Technology and Culture
John Lienhard
HOW INVENTION BEGINS
ECHOES OF OLD VOICES
IN THE RISE OF NEW MACHINES
JOHN H. LIENHARD

Fig. 6 Covers of two books authored by John Lienhard IV, that connect technological and cultural development in popular parlance

But Prof. Lienhard's contributions to research and education have involved far more than finding creative solutions to industrially relevant problems for which he has been widely recognized with many awards as already noted. John is truly a renaissance man of engineering. He has mentored countless doctoral students and took interest in young professionals by providing wise council and assistance (I personally was a beneficiary). And he is a visionary. His creation of *The Engines of Our Ingenuity* series which he wrote and hosted on Public Radio since 1988 reveals a belief that lessons from our past can provide insight into how we view the world today and how technology can make the world a better place in the future. It is among John's most significant legacies.

I am privileged to join in the celebration of the work and impact of Prof. Lienhard in his 91st year, and wish him many more successes. He is a devoted son of technology in all its forms."

Another friend and colleague Yogesh Jaluria writes,

"I met Professor John H. Lienhard for the first time in August 1979 at the University of Kentucky which had become a renowned center for heat transfer research. John had kindly invited me for a seminar on my visit to USA from IIT, Kanpur, where I was a faculty member. Though I was familiar with the outstanding research carried out by John and his students on boiling, this was the first time I had the pleasure of meeting and talking with him. I was amazed at his deep insight, clear thought, and extraordinary interests, even in areas far removed from his own area of research and expanding to social, historical, and cultural issues. It was wonderful to hear his ideas and possible solutions to many challenges facing education in USA and around the world.

I met him several times after that, at the University of Houston, where he had relocated, or at conferences. His talks were always well attended and impressive, though sometimes controversial. But he was always frank, truthful, and convincing. I heard his talks on the radio and read his writings on *The Engines of Our Ingenuity* and other fascinating topics. He was kind enough to gift me his books on these amazing and interesting talks. I remember having a long, enjoyable chat with him on the ground- breaking contributions by Indian Scientists and Mathematicians. We also talked about the subtle but important contributions by women to science and mathematics. It has certainly been a pleasure spending time with John and learning from him. I would like to wish him a very happy and pleasant 90th birthday, hoping that the years ahead keep him active, cheerful, creative and healthy."

Finally, his son, John H. Lienhard V (also a professor of heat transfer), adds:

"The friends and colleagues have described so well the kind of mentor my father has been to so many younger people. He has also been my mentor, and I am still learning from him. Let me add only briefly: the path on which my father has led me is lit by a passion for knowledge, driven by a commitment to excellence without compromise, and bounded by the understanding that we must put what is right ahead of what is convenient. And, as I have learned, this is the true path of both engineers and educators."

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